

Epitomes

Important Advances in Clinical Medicine

Neurosurgery

The Scientific Board of the California Medical Association presents the following inventory of items of progress in neurosurgery. Each item, in the judgment of a panel of knowledgeable physicians, has recently become reasonably firmly established, both as to scientific fact and important clinical significance. The items are presented in simple epitome and an authoritative reference, both to the item itself and to the subject as a whole, is generally given for those who may be unfamiliar with a particular item. The purpose is to assist busy practitioners, students, research workers or scholars to stay abreast of these items of progress in neurosurgery that have recently achieved a substantial degree of authoritative acceptance, whether in their own field of special interest or another.

The items of progress listed below were selected by the Advisory Panel to the Section on Neurosurgery of the California Medical Association and the summaries were prepared under its direction.

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Early Versus Delayed Operation in Subarachnoid Hemorrhage

SUBARACHNOID HEMORRHAGE from a ruptured intracranial berry aneurysm remains a major source of morbidity and mortality in adults, afflicting patients in their most productive years. Many die before reaching a hospital, while others succumb to rebleeding and vasospasm after their original hemorrhage.

Rebleeding is most frequent in the first three weeks following aneurysmal rupture—its peak being at day 1—and kills and disables an additional 17% of patients reaching referral centers. Symptomatic cerebral vasospasm occurs in about a third of the patients between day 3 and day 21 and causes severe stroke or death in half of these. Traditionally, definitive surgical treatment (clipping of the aneurysm) has been delayed to avoid inducing or aggravating vasospasm in the acute state and to allow the cerebral swelling that follows the initial rupture to resolve. Because patients die while awaiting an operation, however, there has been recent interest in earlier operative intervention. Early surgical intervention effectively decreases the incidence of rebleeding and allows a more aggressive medical management of vasospasm using hypertension and hypervolemia without the risk of another rupture. It also allows the removal of spasmogenic clot from the basal cisterns, and it reduces medical complications related to prolonged bed rest and antifibrinolytic therapy.

A recently completed cooperative study addressed the problem of management morbidity and mortality with early versus delayed surgical treatment. Preliminary findings suggest that an early operation may improve overall outcome in most patients. In good grade patients, the surgical mortality does not significantly change if an operation is done early. Clearly, more patients die while waiting for a delayed surgical procedure than die as a result of increased risks of an early one. Furthermore, early operation does not increase the incidence or worsen the outcome of symptomatic vasospasm. Only patients with severe clinical vasospasm at the time of

presentation appear to benefit from cautious delay of the operation until symptoms have cleared.

It is foreseeable that an increased awareness of this entity in the general population will lead to a much earlier recognition of the disease through its warning symptom—that is, sentinel leak—and early surgical repair can be carried out before the devastating effects of major aneurysmal rupture occur.

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Chronic Benign Pain Management

CHRONIC BENIGN PAIN is estimated to affect as many as 20 million people in the United States, representing an enormous loss of productivity, large medical expenses and considerable suffering for the persons so affected. A multidisciplinary team approach to pain management emphasizes an accurate initial diagnosis and treatment directed at reducing drug dependence and increasing functional capabilities. Techniques used include behavioral modification, physical therapy, transcutaneous electrical stimulation, nerve blocks, hypnosis, biofeedback and acupuncture, among others.

In general, neurosurgical therapy for chronic benign pain should be used only after a thorough trial of treatment by a multidisciplinary pain management team. Two recent neurosurgical procedures for treating chronic benign pain include electrically stimulating deep brain structures and placing lesions in the dorsal root entry zone of the spinal cord. The brain stimulation technique is based on results of studies in animals that showed powerful pain inhibitory pathways descending from the periaqueductal grey region of the brain stem and

from the thalamus to the dorsal horn region of the spinal cord. In the animal studies, analgesia from periaqueductal stimulation appeared to be related to release of naturally occurring opiatelike substances, the so-called endorphins. The neurotransmitters involved in pain relief for lateral thalamic stimulation are unknown. To treat chronic pain in humans, these pain-inhibiting systems may be electrically activated by stereotactic placement of stimulation electrodes in either brain site. Pain may be relieved in 65% to 70% of patients by the brain-stimulating technique, with few complications and without interference with normal neurologic function. Excellent results have been obtained in patients with chronic back and leg pain after unsuccessful spinal operations. Good results have also been obtained in patients with chronic pain due to trauma, postherpetic neuralgia, anesthesia dolorosa and certain nerve entry injuries.

The technique of placing lesions in the dorsal root entry zone is based on studies that showed neuronal hyperactivity in the dorsal horn of the spinal cord following deafferentation. Made by either a radio-frequency electrode technique or with a laser, these lesions have relieved chronic pain in a high percentage of patients following spinal cord injury and avulsion of the brachial or lumbar nerve plexuses. Because this technique is used for treating pain following deafferentation, pain relief may be accomplished without further loss of neurologic function.

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Intraoperative Monitoring With Ultrasonography

VARIOUS METHODS have been used in the past to locate intraoperatively lesions of the central nervous system. These techniques have usually required that the neurosurgeon transfer static information from diagnostic imaging studies to the operative situation. By applying ultrasonography to neurosurgical procedures, it has become possible to utilize data as it is generated (real-time) in localizing lesions.

The usual method of scanning for intracranial lesions is to first scan transdurally with a low-frequency transducer. In this way, the operator may become oriented by identifying structures such as the ventricles and the falx cerebri. Once the dura is opened, the lesion may be further characterized by using transducers that provide higher resolution. When scanning the intraspinal contents, the surgical wound is filled with sterile saline that serves as a coupling agent. Using a high-frequency transducer, scanning is carried out in a systematic manner noting the position of structures such as the central canal. Using the scanner's computer, the depth and the size of intracranial and intraspinal lesions may be determined.

Intraoperative ultrasonography enables a surgeon to

readily identify lesions with high echogenicity, such as solid tumors, hematomas, displaced bone and missile fragments, and those with low echogenicity, such as abscesses, syringomyelic cysts and enlarged ventricles. Excision, aspiration, biopsy or cannulation may then be done and monitored under ultrasonic control.

Except in infants with an open anterior fontanelle, an opening in the intact calvarium or the spine must be created to accommodate the ultrasonic probe. As intraoperative ultrasonography continues to be widely used in neurosurgical procedures, it is anticipated technology will provide probes requiring smaller bone openings.

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Diagnosis and Surgical Management of Cervical Syringomyelia

CERVICAL SYRINGOMYELIA is a cystic dilation that develops in the cervical spinal cord, typically originating in the region of the vestigial central canal. Clinically, syringomyelia produces pain and progressive sensory loss to pain and temperature modalities in the upper extremities and upper cervical-thoracic region and with time can lead to a complete loss of spinal cord function below the lesion. The natural history of syringomyelia is highly variable. While some patients' conditions improve or stabilize without surgical therapy, others deteriorate even with the most aggressive intervention. While the cause of cervical syringomyelia is unclear, it commonly develops in patients with the cerebello-medullary malformation syndrome (Arnold-Chiari syndrome) with obstruction of the outlet foramina of the fourth ventricle. In some cases, no causative factors can be identified. Posttraumatic syringomyelia can develop in patients with spinal cord injury, typically in those with complete traumatic spinal cord transection in the thoracic region. In these cases, indolent progressive loss of sensory and motor function above the level of spinal cord transection may indicate the development of a syrinx. Occasionally intramedullary spinal cord tumors can also be associated with cystic accumulations of fluid within the spinal cord that can mimic the syndrome of syringomyelia.

The neuroradiologic diagnosis of syringomyelia has been greatly facilitated by the development of magnetic resonance (MR) imaging, in that MR imaging provides a complete visualization in the sagittal plane of the cervical cord, craniocervical junction and related regions. Also, associated hydrocephalus, cerebellar tonsillar and posterior fossa abnormalities can be visualized with their relationship to the cervical spinal cord. Operative strategies may be planned based on the MR imaging data. In addition, its use avoids invasive procedures such as myelography or cisternography and it can be done on an outpatient basis.

A large number of operations have been advocated for treating syringomyelia, including posterior fossa decompression with or without plugging of the communication of the